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ABSTRACT

This study examines the differences in classificatory performance of children from middle class (MC) and from culturally deprived (CD) backgrounds at kindergarten and second grade levels. It was hypothesized that: (a) the ability to classify increases with age (b) CD children would score lower on talks of classification than children in MC groups (c) the range of differences between the two special groups would be greater for the second grade than for the kindergarten children (d) there is a difference in the justification scores favoring the advantaged over the deprived groups. Eighty subjects, in four groups of twenty each, participated. Four classification tasks of Piaget were used (Changing Criteria, Classification, Class Inclusion, and Matrices). Subjects were individually interviewed, asked the same questions and presented the four tasks in sequence. Findings supported the hypothesis that the ability to classify increases with age. They also pointed to a significant difference between the performance and the justification scores of the two social groups. Findings from this study indicated an almost parallel development between the two grade levels of the two social classes. It might be profitable to repeat this study with a wider range of age levels and with a larger sample to ascertain the presence or absence of social class differences in classificatory performance. (WY)

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Piaget's Concept of Classification: A Comparative Study of Socially Disadvantaged and Middle-Class Young Children

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Classification concepts are very basic to intellectual operations and are the foundations of logical thought.

Indelder and Piaget (1959) studied intensively the development of classification and seriation and reported in the book: "La Genèse des Structures Logiques Elémentaires" which had been translated into English by F. A. Lunzer and D. Papert: "The Early Growth of Logic in the Child," (1964).

Kofsky (1966) used the technique of scalogram analysis to test Piaget's theory that there is a fixed order in which classification concept is acquired. Kofsky found that there was a significant correlation between S's age and the number of tasks mastered and the order of difficulty of the tasks mastered and the order of difficulty of the tasks corresponded to the predicted order.

Almy (1966) did a longitudinal, then a cross sectional study, dealing with the development of children's thinking processes in early childhood. She found that logical development of children

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followed the same sequence in both social groups, but the deprived group had a slower pace. She also found that verbal facility was impaired in the lower group.

Sigel (1966) found that it is possible to induce changes in classificatory behaviors by specific classificatory training procedures. He also found that exposure to verbal experiences and role playing did not significantly alter classificatory skills.

The above studies seem to confirm Piaget's theory that the development of classification is originated early in life and follows a slow and gradual change toward equilibrium. The entire process takes place in, and is shaped by, the social, cultural and educational context.

The present study has the purpose to study the differences in classificatory performances of children of two social classes at kindergarten and second grade levels.

The following hypotheses were tested:

a. The ability to classify increases with age.

b. Both kindergarten and second grade children of the CD groups score lower on tasks of classification than do children in the MC groups.

c. The range of differences between the two social groups is greater for the second grade than for the kindergarten children.

d. There is a difference in the justification scores favoring the advantaged over the deprived groups.

e. There is a sex difference in performance on tests in both social groups.

METHOD

Sample

A total of 80 subjects were drawn from two grade schools in Urbana, Illinois forming four groups of 20 each:

Group I:	20 kindergarten, CD (12 boys & 8 girls)
Group II:	20 kindergarten, MC (11 boys & 9 girls)
Group III:	20 second grade, CD (12 boys & 8 girls)
Group IV:	20 second grade, MC (11 boys & 9 girls)
	Mean Age for groups I & II: 5;3
	Mean Age for groups III & IV: 7;6

Subjects were classified as middle class (MC) or culturally deprived (CD) by the principal and teachers of each school. Their selection was based on the knowledge of the parents' occupation, educational level and location of the home. An additional sample of 20 Negro subjects was used to study differences between races, but these 20 subjects were not included in the main study because the sample was not well representative of the four groups in the study. Kindergarten children were chosen as subjects because kindergarten is the starting point of school life. Second grade was taken, because according to Piaget, seven years is the pivotal age of any development of logical thinking.

Materials

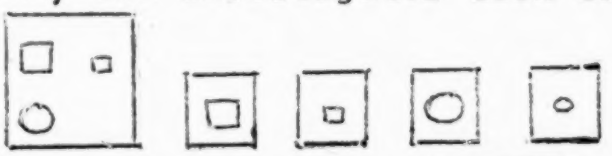
Four classification tasks of Piaget were used in the study.

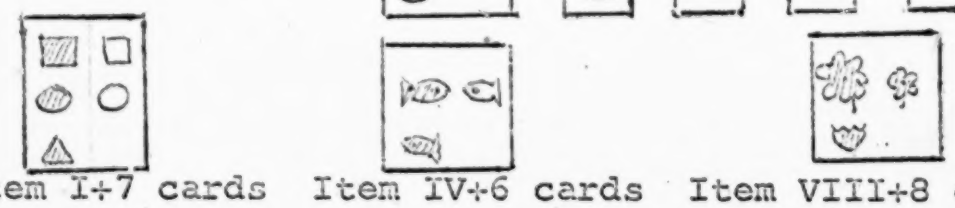
Task I: "Changing Criteria."
Forty geometric figures were cut out of construction paper with differences in sizes (1 & 2 inches in diameter), colors (yellow and red) and shapes (squares & circles).

Task II: "Classification."
Miniature toy objects were grouped into four classes: people, animals, houses, eating utensils. Objects were selected on the basis of familiarity to most of the children and of a size small enough to fit on the four sheets of paper.

Task III: "Class Inclusion."
A box containing 20 wooden beads (class B); 18 of them red (class A) and 2 of them yellow (class A'). A string is also included.

Task IV: "Matrices or multiplicative classification."
Piaget's matrice task is composed of nine items. For the practical reason relating to the desirable length of time of the testing period, the investigator took only four items:

1. The practice item: 



2. Item I+7 cards Item IV+6 cards Item VIII+8 cards

Procedure

S's were individually interviewed, asked the same questions and presented the four tasks in the sequence: Changing Criteria (I), Classification (II), Inclusion (III), Matrices (IV).

Task I: Changing criteria.

-S was asked to classify the materials as he saw fit. "Can you put into piles the things that go together?" 'Can you separate things that are different?"

-S was asked to make a dichotomy using two large boxes and state the justification for his action.

-S was asked for alternative classification up to a maximum of three and the justification for his choice.

Task II: Classification.

S was asked to name a few objects to assure that they are familiar to him. Four sheets of paper were put on the table and E asked S to put on each sheet, "whatever goes together." The sheets forced S to unite objects into small collections.

Task III: Class-Inclusion.

The 20 wooden beads, 18 reds and 2 yellows were divided into three classes: A' (yellow) A (red) B (wooden). E made sure that S understood the inclusion problem: "All the yellow beads are made of wood; all the red beads are made of wood." General questions on inclusion were asked: "Which of the two necklaces would be longer, the one made with the red beads or the one made with wooden beads?" Questions on quantification of inclusion followed: "If you give me all the red beads, what will be left in the box?" "If you give me all the wooden beads, will there be any beads left?" S was asked to give justification for each of his answers.

Task IV: Matrices.

Each item was presented to S, one at a time. The multiple choices were presented one by one and S was allowed to try each of them in the empty cell. After the presentation of the practice item, two questions were asked in each of the other three items: (a) to find the correct picture, and (b) to justify the choice.

The experimental session lasted from 20 to 30 minutes. It should be noted that children were visibly interested in Piaget's tasks.

The testing room was a separate place in the library or in a conference room of the school. The experiment was introduced under the form of a game. S's responses and justifications were

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recorded as completely as possible on individual mimeographed sheets. For reliability of the results, half of the total number of S's responses were recorded on tape recorder for a second judge's scoring.

In the treatment of data, each correct response was scored 1 point; these raw scores were then transformed into proportional scores to use in a three way analysis of variance. Percentage of success was also used for more detailed analysis of responses. A qualitative classification of responses into stages of development in classification was another means used to categorize responses of S's.

In selecting the four tasks mentioned, the investigator considered the following factors:

- Level of difficulty of the tasks for both age groups so that the performances on the tasks can be compared meaningfully.

- The time limit to about 30 minutes for each testing period.

- The tasks should cover the main problems in classification. The first task was for the study of the shifting of criteria; the second task used real objects to see if the materials would be a handicap or a help in classifying; the third task on inclusion problem was the crucial task to show if subject grasped the true class inclusion operation or not. These three tasks were for the additive classification and the fourth task was for multiplicative classification.

RESULTS

1. It was found that the ability to classify increases with age. The results from the analysis of variance (Table 1) indicated a significant difference between grade levels for both social classes.

Insert Table 1 about here

Raw scores were converted into percentage and the results of the performance of each group in each task were presented in Figure 1.

Insert Figure 1 about here

The percentage of success in each of the four tasks increased considerably from kindergarten to second grade for both social classes (Fig. 1). Figure 1 also showed that all the second grade children in both social classes scored at better than the 50% level of success in the three classification tasks (I, II, III). For the matrices task (IV) which was the most difficult among the four tasks used, only the second graders of the MC group were over the 50% success level.

A Z test was computed to further test the significance of differences between grade levels. Results in Fig. 1 showed that in task I, a significant increase of 40% to 100% was found between the kindergarten and second grade groups among the CD (observed $Z = 4.13$; $p < .0001$). In the MC groups, differences of 85% and 100% between the two grade levels were significant ($Z = 1.80$; $p < .05$).

In Task II, the differences between grade levels were significant for both social groups: (CD: 5% to 75%; Z= 3.87; p.<.001; MC: 45% to 80%; Z= 2.73; p.<.01). The same significant differences for grade levels were found for Tasks III and IV.

Results from the present study clearly supported the hypothesis stating that the ability to classify increases with age. It also supported Piaget's contention that seven years is a pivotal age in logical development.

2. It was found that the CD groups progressed at a slower pace in classification that children in the MC groups. According to this hypothesis, experience is a contributing factor to classification development. Opportunities to classify objects or events in the environment would be considered as facilitating development, and such opportunities would, presumably, be more available to the MC child. The hypothesis was supported by results of the analysis of variance (Table 1); there was a significant difference between social classes (F= 49.62; df= 1/76; p.<.001).

Classification of S's responses into three stages of development was used to compare performances among the four groups. The summary of results was presented in Table 2.

Insert Table 2 about here

Table 2 revealed that most of the CD kindergarten children (85%) were in Stage I, while the MC kindergarten (75%) were mostly in Stage II.(70%), while the MC were in Stage III (65%).

A Z test was computed to further test the significance of differences between percentages of success in each task for the two grades and two social classes. The results were significant for all four tasks used.

3. Results from the present study did not support the hypothesis of range of difference between the two social groups. Results from the analysis of variance showed that the interaction between grade and social factors were significant at 5% level, but not at 1% level of significance ($F= 4.61$; $df= 1/76$; $p.<.05$).

The range of differences between social classes shown in Figure 2 appeared to be closer at second grade level than at the kindergarten level.

Insert Figure 2 about here

Contrary to expectations, the two years of schooling of the second grade children in the CD groups seemed to bring them closer to the MC groups.

4. Differences in the reasoning process was also found among the two social groups. To test this hypothesis, only data from Task III and Task IV were used because these two tasks demanded more abstract reasoning and the justification part gave a better insight into the reasoning process. The CD groups tended to be less clear in their justification given for their performances than the MC children. A Z test was computed for each difference between proportions of justification scores in each item of Task

III and IV and the results were significant for both tasks.

5. Differences between sexes were not significant in the present study. A t test was used for the analysis.

DISCUSSION AND CONCLUSION

The present study supported Piaget's theory that there is a sequence in logical development and that stages of development are related to chronological age. The results also supported Piaget's theory of equilibration which stresses the continual interaction between the individual and the environment. Opportunities for such interaction are often missing in deprived environments and may contribute to differences in levels of development. In the present study, both kindergarten and second grade children of the CD groups scored considerably lower in all classification tasks than children of the MC groups. An analysis of variance showed a clearly significant effect of age factors and of social factors, findings in agreement with the results of Almy's study (1966) conducted with children of the same age groups and of two social classes, although Almy's study was concerned mostly with concept of conservation.

Another hypothesis predicted that the effect of milieu on development would be such that the range of difference between the two social groups would be greater at the second grade than at the kindergarten level. The results did not support the hypothesis. The comparison between the two social classes and the two grade levels showed that they varied with the tasks used. In Task I,

III, IV, there was an almost parallel development between the two grade levels of the two social classes. In Task II, there was a closer discrepancy between second graders of CD and MC groups than the discrepancy between the two kindergarten groups. An interpretation of the finding was that classifying concepts were easier with concrete objects. In Task II, miniature toys were used, the CD groups were able to perform better with this classification task. Another possible interpretation of the finding was that the two years of schooling may bring the CD groups closer to the MC groups, at least in the development of the classification concept.

Cultural influence upon the attainment of classification concept was another interesting point to consider. A comparison between results obtained by Geneva groups and those of the present study was presented in Table 3.

Insert Table 3 about here

Geneva children scored lower than children in the present study for both age groups of five and seven. In general, there was a difference of about two years between the two samples. It was not surprising to find that different samples of children attain these concepts at somewhat different ages. Piaget himself has stated that such variation would be expected among different cultural groups (1964). These cultural differences only confirmed results from Father Pinard and Laurendeau (Ripple and Rockcastle 1964) who found a delay of several years among children in Martinique

in comparison with those in Montreal. It also supported results of Hyde's study (1959) with European and Arabic children and Goodnow's (1962) investigation with English and Chinese children.

The discrepancy with respect to age of attainment of concept between Geneva and American children may be explained by the fact that the Geneva results came from a study conducted at least ten years ago. The finding also suggested the possible causes in educational differences between the two continents and differences in cultural emphasis on development of classificatory concepts between the two societies. But the finding of differences in age of attainment did not contradict the general notion of Piaget regarding sequential development of intellectual processes. The investigator found the same types of obstacles to success as in the Geneva study.

To sum up, the finding of the present study supported hypothesis that ability to classify increases with age. It also pointed to a significant difference between the performance and the justification scores of the two social groups. But the sample of the study was small and limited to two ages -- five and seven. It would be profitable to study differences among social classes, with a wider range of age levels, for a better understanding of the developmental process of classification and the possible answer to the problem of "match" between education and environment.

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TABLE I

SUMMARY OF ANALYSIS OF VARIANCE

Source of Variation	df	MS	F
Between subjects	79		
A (grades)	I	739.33	I70.24***
B (social classes)	I	2I5.50	49.62***
Grades x Soc. Classes	I	20.00	4.6I*
Error between (Subjects within groups)	76	4.34	
Within subjects	240		
Tasks	3	I89.37	40.60***
Tasks X Grades	3	5.59	I.20
Tasks X Soc. Classes	3	3.84	ns
Tasks X Grades X Soc.Cl.	3	23.94	5.I3**
Error within (Tasks X Subjects within groups)	228		

Significance level: * .5%
** .I%
*** .0I%

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TABLE 2

COMPARISON BETWEEN GROUPS IN STAGE DEVELOPMENT

Group I (Kdgn CD)	85% ← Stage I → 25%		Group II (Kdgn MC)
	10% ← Stage II → 75%		
Group III (2nd gr.CD)	70% ← Stage II → 35%		Group IV (2nd. MC)
	30% ← Stage III → 65%		

COMPARISON BETWEEN RESULTS FROM GENEVA STUDY AND RESULTS FROM PRESENT STUDY IN CLASSIFICATION TASKS.

Task I: Changing Criteria

Geneva Study Results					Present Study Results			
	Age				Group			
					Kdgn		2nd grade	
Responses	5	6	7	8-9*	I(CD)	II(MC)	III(CD)	IV(MC)*
2 Criteria	27	47	56	31	30	40	25	00
3 Criteria	0	29	28	69	I0	45	75	I00
At least 2 Criteria	27	76	84	I00	40	85	I00	I00

Task III: Inclusion

Age	5	6	7	8	9**	I	II	III	IV
Success	7	I3	40	60	70	05	25	55	80

Task IV: Matrices

Age	4	5	6	7	8***	I	II	III	IV
2 Criteria	0	I2	57	62	88	37.5	52.5	27.5	37.5
3 Criteria	I2	I2	I4	37	22	I0	25	40	62.5

*Results from Inhelder and Piaget, I964, Table XVIII, P. 209

** Results from Ving Bang (in preparation, obtained through personal communication)

***Results from Inhelder and Piaget; I964, Table XVI, p. I63.

* Average Age for
Kindergarten: 5;3
2nd grade: 7;6

Fig. I. Distribution of Results in Percentage of Subjects Reaching each Level in each of the Four Tasks.*

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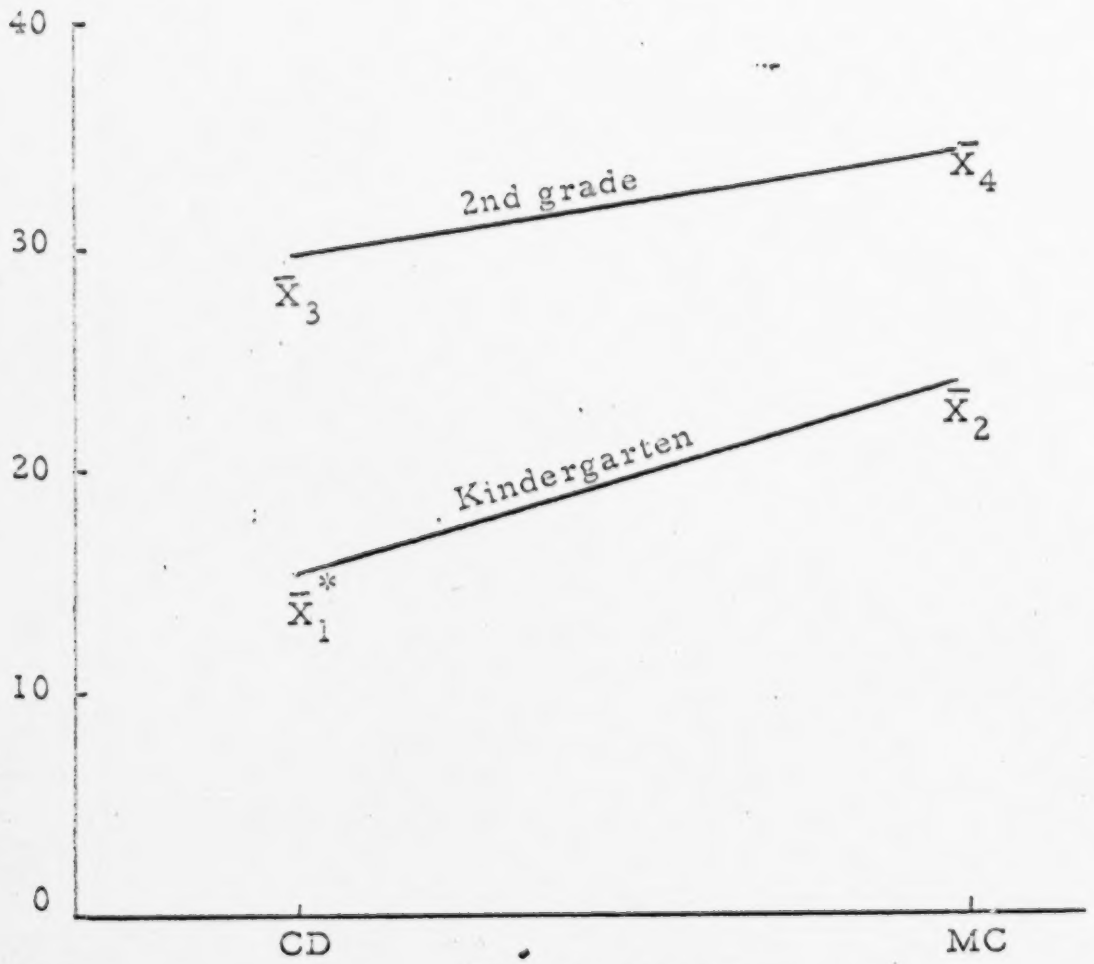
Fig. 2.

Comparison of the Mean of Proportional Scores
Between Two Social Classes and Two Grade Levels
in all Four Tasks



$\bar{X}_1^*$ = 15.38 (= mean of proportional scores in all 4 tasks for group I)

$\bar{X}_2$ = 23.95 (= mean prop. scores in group II)

$\bar{X}_3$ = 29.54 (= mean prop. scores in group III)

$\bar{X}_4$ = 34.11 (= mean prop. scores in group IV)

FOOTNOTE

This paper is based upon a thesis submitted by the author in partial fulfillement of the requirements for the degree of Doctor of Philosophy in Education at the University of Illinois.

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